WHAT IS CLAIMED IS

1. A method of producing a single crystal body of a group III nitride, comprising the steps of:

forming a molten flux of a volatile metal element in a reaction vessel confining therein said molten flux together with an atmosphere containing N (nitrogen), such that said molten flux contains a group III element in addition to said volatile metal element;

growing a nitride of said group III element in the form of a single crystal body in said molten flux; and

supplying a compound containing N into said reaction vessel from a source located outside said reaction vessel.

2. A method as claimed in claim 1, wherein said compound comprises N_2 and NH_3.

3. A method as claimed in claim 1, wherein said volatile metal is an alkali metal.

4. A method as claimed in claim 1, wherein said volatile metal element is Na.

5. A method as claimed in claim 1, wherein said volatile metal element is K.

6. A method as claimed in claim 1, wherein said molten flux further contains therein a source of said group III element at a location away from a melt surface of said molten flux, said step of growing said nitride single crystal body including the steps of decomposing said source so as to cause said source to release said group III element into said molten

flux, and transporting said group III element from said source to said melt surface through said molten flux.

7. A method as claimed in claim 6 wherein said step of transporting said group III element includes a step of inducing a temperature gradient in said molten flux such that said molten flux has a temperature lower than a temperature of said melt surface in a part of said molten flux in which said solid source is located.

8. A method as claimed in claim 6, wherein said solid source is an intermetallic compound of said group III element and said volatile metal element.

9. A method as claimed in claim 6 wherein said solid source is a nitride of said group III element.

10. A method as claimed in claim 1, wherein said step of supplying said compound containing N into said reaction vessel is conducted such that said single crystal body grown in said molten flux maintains a predetermined stoichiometry.

11. A method as claimed in claim 1, further comprising the step of supplying said group III element into said molten flux from a source located outside said molten flux.

12. A method as claimed in claim 11,

wherein said step of supplying said group III element into said molten flux is conducted by supplying a melt of said group III element into said molten flux.

13. A method as claimed in claim 11, wherein said step of supplying said group III element into said molten flux is conducted by supplying a melt of said group III element and said volatile metal element into said molten flux.

14. A method as claimed in claim 1, wherein said step of growing said single crystal body of nitride comprises the steps of contacting a seed crystal with said molten flux and pulling up said seed crystal from said molten flux in an upward direction with a progress of growth of said single crystal body on said seed crystal.

15. A method as claimed in claim 1, wherein said step of growing said single crystal body comprises the steps of contacting a seed crystal with said molten flux and pulling down said seed crystal into said molten flux in a downward direction with a progress of growth of said single crystal body on said seed crystal.

16. A method as claimed in claim 1, further comprising a step of supplying a vapor of said volatile metal element into said reaction vessel from an external source.

17. A method of producing a single crystal body of a cubic GaN, comprising the steps of:

forming a molten flux of K in a reaction vessel confining therein said molten flux together with an atmosphere containing N (nitrogen), such that said molten flux contains Ga in addition to K; and

precipitating a single crystal body of cubic GaN in said molten flux.

18. A method as claimed in claim 17, further comprising the step of supplying a compound containing N (nitrogen) into said reaction vessel from an external source outside said reaction vessel.

19. A method as claimed in claim 17, wherein said precipitation is conducted by controlling a temperature of a melt surface of said molten flux at 650 - 850° C.

20. A method of fabricating a semiconductor device having a bulk crystal substrate of a nitride comprising the step of:

forming a molten flux of a volatile metal element in a reaction vessel confining therein said molten flux together with an atmosphere containing N (nitrogen), such that said molten flux contains a group III element in addition to said volatile metal element;

growing a nitride bulk crystal of said group III element in said molten flux; and

supplying a compound containing N into said reaction vessel from a source located outside said reaction vessel.

21. A method as claimed in claim 20, wherein said compound comprises N_2 and NH_3.

22. A method as claimed in claim 20, wherein said volatile metal is an alkali metal.

23. A method as claimed in claim 20, wherein said volatile metal element is Na.

24. A method as claimed in claim 20, wherein said volatile metal element is K.

25. A method as claimed in claim 20, wherein said molten flux further contains therein a source of said group III element at a location away from a melt surface of said molten flux, said step of growing said nitride bulk crystal including the steps of decomposing said source so as to cause said source to release said group III element into said molten flux, and transporting said group III element from said source to said melt surface through said molten flux.

26. A method as claimed in claim 25 wherein said step of transporting said group III element includes a step of inducing a temperature gradient in said molten flux such that said molten flux has a temperature lower than a temperature of said melt surface in a part of said molten flux in which said source is located.

27. A method as claimed in claim 25, wherein said solid source is an intermetallic compound of said group III element and said volatile metal element.

28. A method as claimed in claim 25 wherein said solid source is a nitride of said group III element.

29. A method as claimed in claim 20, wherein said step of supplying said compound containing N into said reaction vessel is conducted such that said nitride bulk crystal of said group III element growing in said molten flux maintains a predetermined stoichiometry.

30. A method as claimed in claim 20, further comprising the step of supplying said group III element into said molten flux.

31. A method as claimed in claim 20, wherein said step of supplying said group III element into said molten flux is conducted by supplying a melt of said group III element into said molten flux from a source located outside said molten flux.

32. A method as claimed in claim 20, wherein said step of supplying said group III element into said molten flux is conducted by supplying a melt of said group III element and said volatile metal element into said molten flux from a source located outside said molten flux.

33. A method as claimed in claim 20, wherein said step of precipitating said bulk crystal comprises the steps of contacting a seed crystal with said molten flux and pulling up said seed crystal from said molten flux in an upward direction with a progress of growth of said bulk crystal on said seed crystal.

34. A method as claimed in claim 20, wherein said step of precipitating said bulk crystal comprises the steps of contacting a seed crystal with said molten flux and pulling down said seed crystal

into said molten flux in a downward direction with a progress of growth of said bulk crystal on said seed crystal.

35. A method as claimed in claim 20, further comprising a step of supplying a vapor of said volatile metal element into said reaction vessel from a source located outside said reaction vessel.

36. A method of fabricating a semiconductor device having a bulk crystal substrate of a cubic GaN, comprising the step of:

forming a molten flux of K in a reaction vessel confining therein said molten flux together with an atmosphere containing N (nitrogen), such that said molten flux contains Ga in addition to K; and

growing a bulk crystal of GaN of a cubic crystal system at a melt surface of said molten flux.

37. A method as claimed in claim 36, further comprising the step of supplying a compound containing N (nitrogen) into said reaction vessel from a source located outside said reaction vessel.

38. A method as claimed in claim 36, wherein said precipitation is conducted by controlling a temperature of said melt surface at 650 - 850° C.

39. A bulk crystal substrate of GaN, comprising:

a slab of a GaN single crystal having a substantially uniform composition of GaN in a thickness direction of said slab,

said slab having a defect density lower than about $10^{-3}cm^{-3}$.

40. A bulk crystal substrate of GaN as claimed in claim 39, wherein said slab has a thickness exceeding about 100μm

41. A bulk crystal substrate of GaN as claimed in claim 39 wherein said slab has a thickness exceeding about 300μm.

42. A bulk crystal substrate of GaN as claimed in claim 39, wherein said slab has a defect density lower than about $10^{-2}cm^{-3}$.

43. A bulk crystal substrate of GaN as claimed in claim 39, wherein said slab is formed of GaN of a hexagonal crystal system.

44. A bulk crystal substrate of GaN as claimed in claim 39, wherein said slab is formed of GaN of a cubic crystal system.

45. An optical semiconductor device, comprising:

a bulk crystal substrate of a GaN single crystal; and

an active layer formed over said bulk crystal substrate with epitaxy to said bulk crystal substrate.

46. An optical semiconductor device as claimed in claim 45, wherein said single crystal of GaN constituting said bulk crystal substrate belongs to a hexagonal crystal system.

47. An optical semiconductor device as claimed in claim 45, wherein said GaN single crystal constituting said bulk crystal substrate belongs to a cubic crystal system.

48. An optical semiconductor device as claimed in claim 45, wherein said bulk crystal substrate of GaN has a defect density smaller than about $10^3 cm^{-3}$.

49. An optical semiconductor device as claimed in claim 45, wherein said bulk crystal substrate of GaN has a defect density smaller than about $10^2 cm^{-3}$.

50. An optical semiconductor device as

claimed in claim 45, wherein said bulk crystal substrate has a thickness exceeding about 100μm.

51. An optical semiconductor device as claimed in claim 45, wherein said bulk crystal substrate has a thickness exceeding about 300μm.

52. A laser diode, comprising:

a bulk crystal substrate of a GaN single crystal having a first conductivity type;

a lower cladding layer of said first conductivity type formed epitaxially on said bulk crystal substrate;

an active layer formed epitaxially on said lower cladding layer;

an upper cladding layer of a second conductivity type formed epitaxially on said active layer;

a first electrode contacting said upper

cladding layer;

a second electrode provided on a bottom surface of said bulk crystal substrate of GaN; and

a pair of mirror surfaces facing each other.

53. A laser diode as claimed in claim 52, wherein said pair of mirror surfaces are cleaved surfaces.

54. An laser diode as claimed in claim 52, wherein said GaN single crystal constituting said bulk crystal substrate belongs to a hexagonal GaN crystal system.

55. A laser diode as claimed in claim 52, wherein said GaN single crystal constituting said

bulk crystal substrate belongs to a cubic crystal system.

56. A laser diode as claimed in claim 52, wherein said bulk crystal substrate of GaN has a defect density smaller than about $10^3 cm^{-3}$.

57. A laser diode as claimed in claim 52, wherein said bulk crystal substrate of GaN has a defect density smaller than about $10^2 cm^{-3}$.

58. A laser diode as claimed in claim 52, wherein said bulk crystal substrate has a thickness exceeding about $100 \mu m$.

59. A laser diode as claimed in claim 52, wherein said bulk crystal substrate has a thickness exceeding about 300μm.

60. A laser diode as claimed in claim 52, wherein said active layer has a multiple quantum well structure.

61. A laser diode as claimed in claim 60, wherein said active layer further includes a pair of optical waveguide layers below and above said multiple quantum well structure.

62. An electron device, comprising:

a bulk crystal substrate of a GaN single crystal;

an epitaxial layer of a nitride formed on said bulk crystal substrate; and

an active part formed in said epitaxial layer for switching a flow of carriers transported through said epitaxial layer.

63. An electron device as claimed in claim 62, wherein said epitaxial layer includes a channel layer of GaN formed epitaxially with respect to said bulk crystal substrate, and wherein said active part includes a gate electrode provided over said channel layer in correspondence to a channel region defined therein, a source electrode provided over said channel layer at a first side of said gate electrode, said source electrode injecting carriers into said channel layer, and a drain electrode provided over said channel layer at a second side of said gate electrode, said drain electrode collecting carriers from said channel layer.

64. An electron device as claimed in claim 63, wherein said epitaxial layer further includes a barrier layer of a nitride formed epitaxially on said channel layer, and wherein said gate electrode is provided in Schottky contact with said barrier layer.

65. An apparatus for growing a group III nitride bulk crystal, comprising:

a reaction vessel having a space therein for holding a crucible;

a supply line connected to said reaction vessel, said supply line supplying a pressurized gas of a compound containing N (nitrogen) into said reaction vessel; and

a heater disposed outside said reaction vessel, said heater heating said reaction vessel externally so as to form a molten flux of a volatile metal element and a group III element in said crucible.

66. An apparatus as claimed in claim 65, further comprising a pressure-resistant vessel enclosing said reaction vessel.

67. An apparatus as claimed in claim 65, further including a mechanism for supplying a melt of said group III element into said molten flux in said crucible.

68. An apparatus as claimed in claim 67, wherein said mechanism including a container disposed in said space of said reaction vessel at a location above a surface of said molten flux, said container having an opening for allowing said melt of said group III element to fall into said molten flux.

69. An apparatus as claimed in claim 67, wherein said mechanism further supplies a melt of said volatile metal element together with said melt of said group III element.

70. An apparatus as claimed in claim 65, further comprising a mechanism for supplying a vapor of said volatile metal element into said reaction vessel.

71. An apparatus as claimed in claim 65, further comprising a rod adapted for carrying a seed crystal at a tip end and a motor for moving said rod in an upward direction, said rod and said motor being located above a melt surface of said molten flux formed in said crucible.

72. An apparatus as claimed in claim 71, wherein said motor is located outside said reaction vessel.

73. An apparatus as claimed in claim 71, further comprising a cover member covering a surface of said molten formed in said crucible, said cover member having a central opening for allowing said seed crystal to make a contact with said molten flux.

74. An apparatus as claimed in claim 73 wherein said cover member has a variable geometry for changing a size of said central opening.

75. An apparatus as claimed in claim 65, further comprising a rod adapted for carrying a seed crystal at a tip end, said rod being inserted into

said crucible through a bottom part of said crucible, and a motor provided outside of said reaction vessel for moving said rod in a downward direction.

76. An apparatus as claimed in claim 65, wherein said heater induces a temperature gradient in said molten flux in said crucible such that a temperature of said molten flux at a bottom part of said crucible is higher than a temperature at a top surface of said molten flux.

77. An apparatus as claimed in claim 76, wherein said heater includes a first heater part heating a sidewall of said reaction vessel and a second heater part heating a bottom part of said reaction vessel.